Journal of Physics: Conference Series 2018 vol.1092

Porous germanium with Ag nanoparticles formed by ion implantation

Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

© 2018 Institute of Physics Publishing.All Rights Reserved. A novel approach is proposed and tested for the synthesis of thin porous PGe layers with Ag nanoparticles based on low-energy high-dose ion implantation of single-crystal c-Ge. To demonstrate a successes of this technique, an Ag+-ion implantation of a polished c-Ge substrates with an energy of 30 keV at various doses of 1.0·1016 -1.5·1017 ion/cm2 and a current density of 5 μA/cm2 was performed. Various analytical methods such as scanning electron and probe microscopy, as well as EDX analysis and electron backscattered diffraction were applied for observation of PGe formation of a spongy structure consisting of a network of intersecting Ge nanowires. At the ends of the nanowires, the synthesis of Ag nanoparticles were detected. It was also found that the formation of pores during Ag+-ion implantation was accompanied by efficient spattering of the Ge surface.

http://dx.doi.org/10.1088/1742-6596/1092/1/012125

References

[1] T.M. Donovan, K. Heinemann, Phys. Rev. Lett. 27 (1971) 1974-1976.
[2] E.G. Rojas, J. Hensen, J. Carstensen, H. Föll, R. Brendel, ESC Transactions. 33 (2011) 95-102.
[3] G. Flamand, J. Poortmans, K. Dessein, Phys. Stat. Sol. C 2 (2005) 3243-3247.
[4] J. Shieh, H.L. Chen, T.S. Ko, H.C. Cheng, T.C. Chu, Adv. Mat. 16 (2004) 1121-1124.
[5] Kartopu G., S.C. Bayliss, R.E. Hummel, Y. Ekinci, J. Appl. Phys. 95 (2004) 3466-3472.
[6] C. Jing, C. Zhang, X. Zang, W. Zhou, W. Bai, T. Lin, J. Chu, Sci. Technol. Adv. Mater. 10 (2009) 65001-1-65001-6.
[7] I.H. Wilson, J. Appl. Phys. 53 (1082) 1698-1705.
[8] R. Böttger, K.-H. Heinig, L. Bischoff, B. Liedke, S. Facsko, Appl. Phys. A 113, (2013) 53-59.
[9] T. Som, J. Ghatak, O.P. Sinha, R. Sivakumar, D. Kanjilal, J. Appl. Phys. 103 (2008) 123532-1-123532-5.
[10] S. Hooda, S.A. Khan, B. Satpati, D. Strange, D. Buca, M. Bala, C. Pannu, D. Kanjilal, D. Kabiraj, Appl. Phys. A 122 (2016) 227-1-227-7.
[11] A. Polman, Science 322 (2008) 868-869.
[12] H. Atwater, A. Polman, Nature Mat. 9 (2010) 205-213.
[13] A. Cavalcoli, B. Fraboni, G. Impellizzeri, L. Romano, E. Scavetta, M.G. Grimaldi, Microporous and Mesoporous Mater. 196 (2014) 175-178.
[14] J.F. Ziegler, J.P.Biersack, U. Littmark, The Stopping and Range of Ions in Solids. Pergamon Press: New York., 1985.